

Coventry University Repository for the Virtual Environment  
(CURVE)

**Author names:** Claisse, P.A.

**Title:** 'Using sulphate activated pozzolans in controlled low strength materials

**Article & version:** Presented version of powerpoint slides

**Original citation & hyperlink:**

Claisse, P.A. (2005, April). '*Using sulphate activated pozzolans in controlled low strength materials*'. Paper presented at the American concrete institute (ACI) Convention open paper session, New York, USA.

[http://www.concrete.org/EVENTS/ev\\_past\\_conventions.htm](http://www.concrete.org/EVENTS/ev_past_conventions.htm)

Copyright © and Moral Rights are retained by the author(s) and/ or other copyright owners. A copy can be downloaded for personal non-commercial research or study, without prior permission or charge. This item cannot be reproduced or quoted extensively from without first obtaining permission in writing from the copyright holder(s). The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the copyright holders.

Available in the CURVE Research Collection: December 2012

<http://curve.coventry.ac.uk/open>

# Using Sulphate Activated Pozzolans in Controlled Low Strength Materials

- Project Partners and Sponsors
- Sulphate Activated Pozzolans
- Controlled Low Strength Materials
- Sources of Gypsum
- Other Materials
- Lab results
- Site Trial



# Project Partners

- **Coventry University**
  - Dr Peter Claisse
  - Dr Esmail Ganjian
  - Elevtherios Gross
- **Imperial College London**
  - Professor Alan Atkinson
  - Dr Mark Tyrer
  - Rosemary Greaves
- **Birmingham University**
  - Dr Gurmel Ghataora



# Project Sponsors

- The Mini-Waste Faraday Partnership
  - The Environmental and Physical Sciences Research Council
  - The Natural Environment Research Council
- Lafarge Plasterboard
- Huntsman Tioxide



# The Mini-Waste Gypsum Project

- Sulphate activated pozzolans
  - Controlled Low Strength Materials
  - Products (blocks, floor screeds etc.)
  - Trench fill
  - Road bases
- Self-heated product forming
- Production of clean gypsum



# Using Sulphate Activated Pozzolans in Controlled Low Strength Materials

- Project Partners and Sponsors
- Sulphate Activated Pozzolans
- Controlled Low Strength Materials
- Sources of Gypsum
- Other Materials
- Lab results
- Site Trial



# Sulphate Activated Pozzolans

- Super Sulphated Cement was made with blastfurnace slag and gypsum
- Widely used for foundations because of high sulphate resistance
- Discontinued due to poor shelf-life and the introduction of sulphate resisting cements.



# Using Sulphate Activated Pozzolans in Controlled Low Strength Materials

- Project Partners and Sponsors
- Sulphate Activated Pozzolans
- **Controlled Low Strength Materials**
- Sources of Gypsum
- Other Materials
- Lab results
- Site Trial





# Controlled Low Strength Materials

- Low strength mixes for trench backfill etc.
- Not yet widely used in Europe.
- An alternative to foamed concrete for many applications.



# Using Sulphate Activated Pozzolans in Controlled Low Strength Materials

- Project Partners and Sponsors
- Sulphate Activated Pozzolans
- Controlled Low Strength Materials
- Sources of Gypsum
- Other Materials
- Lab results
- Site Trial



# Current Uses of Gypsum

## CLEAN MATERIAL

- cement
- plasterboard and plaster

## CONTAMINATED MATERIAL

- soil conditioner



# Sources of by-product Gypsum

- Flue gas desulphurisation
- Titanium oxide pigment production



- Plasterboard off-cuts
- Spent casting cores etc.



# Red Gypsum

- A by-product of titanium dioxide production (white pigment).
- The red colour comes from iron oxide
- Many other contaminants
- Has been used in agriculture
- Current output 125,000 Tonnes per year



# Red gypsum delivery at Roxby





# Placed red gypsum at Roxby



# Waste Plasterboard

## European Union Regulations

- Must be segregated on site
- Limited amounts can be recycled in the production process
- Cannot be landfilled with municipal waste (produces small amounts of hydrogen sulphide)
- No segregated cells available in the UK
- The organic content (paper) may prevent all landfilling





# Using Sulphate Activated Pozzolans in Controlled Low Strength Materials

- Project Partners and Sponsors
- Sulphate Activated Pozzolans
- Controlled Low Strength Materials
- Sources of Gypsum
- **Other Materials**
- Lab results
- Site Trial



# Candidate materials (1)

- Sodium sulphate slag (Britannia Refined Metals Ltd.)
- Spent borax slag (Britannia Refined Metals Ltd.)
- Ferrosilicate slag (lumps from Britannia Refined Metals Ltd. sand size from Britannia Zinc Ltd.)
- Ferrosilicate copper slag (IMI Refiners Ltd.)
- Soda slag (Britannia Refined Metals Ltd.)
- Chrome Alumina slag (London & Scandinavian Metallurgical Co. Ltd.)
- Cement Kiln Dust ,CKD (Rugby Cement)
- Run of station ash (Ash Resources Ltd.)
- Lagoon ash (UK quality Ash Association)
- PFA (Ash Resources Ltd.)
- Steel slag (Tarmac Quarry Products Ltd.)
- Granulated Blast Furnace Slag, GBS (Tarmac Quarry Products Ltd.)



# Candidate materials (2)

- Burnt Oil Shale (Tarmac Quarry Products Ltd.)
- By-product Gypsum (Biffa Waste Services Ltd.)
- Glass cullet (Mercury Recycling Ltd.)
- GGBS (Ground granulated blastfurnace slag)
- Limex70 (British Sugar Plc.)
- Shell foundry sand (Bruhl UK Ltd., Hepworth Minerals & Chemicals Ltd.)
- Green foundry sand (Castings Plc. And Bruhl UK Ltd.)
- Fire kettle setting (Britannia Refined Metals Ltd.)
- Fine rotary fascia bricks (Britannia Refined Metals Ltd.)
- Sodium sulphate solution (Britannia Refined Metals Ltd.)



# Using Sulphate Activated Pozzolans in Controlled Low Strength Materials

- Project Partners and Sponsors
- Sulphate Activated Pozzolans
- Controlled Low Strength Materials
- Sources of Gypsum
- Other Materials
- Lab results
- Site Trial



# Initial Strength Results

	Percentages of components (blue if interground)										
Water/ solids ratio	Red Gypsum	Plasterboard Gypsum	Limestone calciner dust	Cement Kiln Dust	Dry Run of Stantion Ash	Steel Slag Dust	Steel Slag Dust, ground	Steel Slag Dust weathered	3 day strength	7 day strength	28 day strength
0.16	15	0	0	5	0	80	0		0.5	0.7	2.3
0.19	0	15	0	5	0	80	0		0.2	0.5	1.5
0.20	20	0	0	0	0		80		0.2	0.5	2.3
0.36	20	0	20	20	20		20		0.1	0.2	2.1
0.26	15	0	1	4	0	80	0		0.6		
0.20	15	0	0	5	0	80	0		1.8		
0.00	0	15	0	5	0		0	80	1.0		



# Using Sulphate Activated Pozzolans in Controlled Low Strength Materials

- Project Partners and Sponsors
- Sulphate Activated Pozzolans
- Controlled Low Strength Materials
- Sources of Gypsum
- Other Materials
- Lab results
- **Site Trial**



# Site Trial Mix

- 1 Part Water
- 2 Parts Red Gypsum (40% water as supplied)
- 3 Parts Steel Slag (Basic Oxygen Slag)



# Gypsum/Slag mix trial pour (mixing)





# Gypsum/Slag mix trial pour



# Thank You

[www.claisse.info](http://www.claisse.info)

